

Serial No.: 10/015,757
Atty. Docket No.: P67358US0

REMARKS

The Office Action mailed May 5, 2004, has been carefully reviewed and by this Amendment, Applicant has canceled claim 3, amended claims 1, 5 and 15, and added claims 16 and 17. Claims 1, 4-8, 10, 12, 13 and 15-17 are pending in the application. Claims 1, 5 and 15 are independent. In view of the amendments and remarks contained herein, favorable reconsideration in this application is respectfully requested.

The Examiner objected to the Amendment filed on August 6, 2003, as introducing new matter to the disclosure, namely the submicron width of the dummy fine line patterns presented in claims 5 and 15. Applicant does not agree that this is new matter in view of the drawings. As shown in Figures 2, 3 and 4, the dummy fine line patterns are clearly shown to be of a comparable size to that of the corresponding main fine line patterns, and even somewhat smaller. Therefore, in that the main fine line patterns are disclosed to be of submicron size (see the specification at page 4, line 24; page 5, line 23), the dummy fine line patterns as shown are clearly also of submicron size. A corresponding portion of the specification has been amended herein to set forth in the text what is already shown in the drawings and therefore does not constitute new matter. Favorable reconsideration and withdrawal of the objection is therefore requested.

The Examiner rejected claims 1, 3-8, 10, 12, 13 and 15 under 35 U.S.C. 112, second paragraph, as being indefinite. By this Amendment, Applicant has amended claims 1, 5 and 15 to clarify that the pad pattern, fine line pattern and connection pad pattern of each of the

plurality of metal wire patterns are *formed in one layer*; with this clarification reconsideration and withdrawal of the rejection is requested.

The Examiner rejected claims 1, 3, 5, 6, 8, 10, and 12-14 under 35 U.S.C 103(a) as being unpatentable over U.S. Patent No. 5,534,728 to Kim et al. ("Kim '728") in view of Kim et al, "Investigation of Aluminum CMP to Apply to Sub-Quarter Micron DRAM Devices" ("the Kim article"). Also under 35 U.S.C. 103(a), the Examiner rejected claims 4 and 7 as being unpatentable over Kim '728 in view of the Kim article and Fontana et al., Corrosion Engineering ("Fontana").

By this Amendment, Applicant has amended claims 1, 5 and 15 to clarify that each of the plurality of metal wire patterns includes at least one pad pattern, a fine line pattern, and at least one connection pad pattern for electrically connecting the pad pattern to the fine line pattern; furthermore, the width of each connection pad pattern is in a range between the width of the pad pattern and the width of the fine line pattern. This is not shown by the prior art.

As set forth in the specification at page 5, lines 2-10, corrosion occurs more easily if the area ratio of the fine line pattern to the overall wire patterns is lower. Particularly, because of the large pad pattern, the fine line pattern is corroded. Therefore, as shown in Figures 1-4, each metal wire pattern according to the present invention includes a connection pad pattern 110, 210, 310, 410 having a width in a range between the width of the large pad pattern and the width of the fine line pattern, the connection pad pattern electrically connecting the large pad pattern to the fine line pattern. This is not shown in the prior art.

Kim '728 is directed to a semiconductor device having a corrosion-resistant metal wiring layer in which dummy metal lines are interposed between the endmost actual metal line and a wiring-free region in order to prevent corrosion of the actual metal lines. As acknowledged by the Examiner, Kim '728 does not disclose fine line patterns having a width of less than 1 μ m. In fact, Kim '728 teaches against the use of thin metal lines, noting that "thinner metal lines are especially susceptible to destructive corrosion" (column 1, lines 17-22). Kim '728 further states that it is preferable for the dummy lines to be *wider* than the other metal lines (column 3, lines 24-26). There is nothing in Kim that discloses the area of the fine wire pattern being formed to constitute more than 1% of the total area of all the metal wire patterns (claim 1), or the area of the dummy fine line pattern being formed to be less than 1% of the total area of the metal wire patterns and also less than a value obtained by dividing the area of the main fine line patterns by the total area of all the metal wire patterns (claims 5 and 15). Nor is there anything in Kim '728 that discloses or suggests the use of connection pad patterns as claimed herein.

The fact that the Kim article mentions DRAM device size in the context of CMP processing does not provide the teaching that is lacking in Kim '728 which is necessary to arrive at the present invention. In the Kim article, CMP is identified as a technique important for forming aluminum damascene lines in sub-quarter micron DRAM devices; but this cannot be considered sufficient to teach the inclusion of fine line patterns and dummy fine line patterns within a plurality of metal wire patterns, these fine line patterns having a respective area that is above or below a threshold (1%) relative to the overall area and acting to prevent corrosion of

metal wires from chemical mechanical polishing (CMP) processes as claimed by the present invention. Nor does it teach metal wire patterns that include pad patterns connected to fine line patterns through connection pad patterns, the connection pad patterns having a width that lies between that of the elements being connected thereby.

The basis of the present invention is that the specified inclusion of fine line patterns, pad patterns and connection pad patterns, with the connection pad patterns connecting the large pad patterns to the fine line patterns, as well as the inclusion of dummy fine line patterns, achieves unexpected results, i.e., corrosion prevention for metal wires from CMP processes. There is nothing in Kim '728 or the Kim article that fairly speaks to this combination of elements. Nor is there any prior art range to which the present invention may be compared. Instead, Applicant's designation of the fine line patterns as being "more than 1%" with respect to the total metal wire pattern (claim 1), and of the dummy fine line patterns as being "less than 1%" of the total area (claims 5 and 15), establishes threshold values not known or considered in the prior art, and thus are not merely values to be compared within the context of a previously known range. In sum, the invention of a semiconductor device capable of preventing corrosion of wire patterns according to the area ratio of each wire pattern and with the interconnections of pad patterns, fine line patterns, and connection pad patterns, is not shown or suggested by Kim '728 either alone or in combination with the Kim article.

In summary, the present invention provides a semiconductor device capable of preventing corrosion of the fine metal wire pattern by adjusting an area ratio of the fine metal

wire pattern and the dummy fine metal wire pattern, this area adjustment preferably being effected through the inclusion of connection pad patterns between the pad patterns and the fine line patterns. The cited references do not disclose or suggest a semiconductor device capable of preventing corrosion of the fine metal wire pattern by utilizing such area ratios in the manner currently being claimed.

Support for the amendments to claims 1, 5 and 15 is found in the drawings, namely Figures 2, 3 and 4, in which the relationship of the width of the connection pad patterns to that of the widths of the pad pattern and the fine line pattern, namely that the width of the connection pad patterns is in a range between the widths of the pad and fine line patterns, is plainly evident. A corresponding portion of the specification has been amended herein to set forth in the text what is already shown in the drawings and therefore does not constitute new matter.

As a final comment on amended claim 1, Applicant cannot understand the Examiner's determination that because claim 1 previously indicated therein a desired result, namely that by controlling the area of the fine line pattern relative to the total area of the metal wire patterns corrosion is prevented from a CMP process, that device claim 1 became a product-by-process claim. However, in the interest of simplicity, Applicant has deleted this language from claim 1, without disclaimer or acquiescence in the Examiner's conclusions.

Finally, Applicant also cannot understand the Examiner's citing of Supreme Court precedent with respect to mathematical algorithms and the patentability thereof in connection

with claim 15. Under the examining guidelines, inventions having a real-world application do not become unpatentable simply because contained within them is the use of an algorithm or equation. Applicant is not claiming an abstract mathematical concept but rather an arrangement of specific physical components within a semiconductor device, the dimensions of which are determined on the basis of an equation that relates the areas of such components. The result is a device that reduces corrosion of aluminum or copper wires from a CMP process. This is far removed from the abstractions being addressed by the Supreme Court, and well within the patentable subject matter defined by the examining guidelines.

For at least the foregoing reasons, Applicant respectfully requests that the Examiner reconsider and withdraw the rejection of claims 1, 5 and 15. Claims 3, 4, 6-8 and 10, 12 and 13 are also in condition for allowance as claims properly dependent on an allowable base claim and for the subject matter contained therein.

With respect to the new claims, claims 16 and 17 are in condition for allowance as claims properly dependent on an allowable base claim and for the subject matter contained therein, since neither the spacing of the dummy fine line patterns from the main fine line patterns (claim 16) nor the coupling of the dummy fine line patterns to large dummy pad patterns (claim 17) is shown or suggested in the prior art. Support for claim 16 is found in the specification at page 6, lines 16-19, and in Figures 2, 3 and 4, in which the spacing of the dummy fine line patterns from the main fine line patterns is clearly shown to be at approximately the width of the main fine line pattern. A corresponding portion of the specification has been amended herein to

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set forth in the text what is already shown in the drawings and therefore does not constitute new matter. Finally, support for claim 17 is found in the specification at page 7, lines 7-13, and in Figure 3.

Accordingly, for at least the foregoing reasons, the pending claims are in condition for allowance. Should the Examiner have any questions or comments, the Examiner is cordially invited to telephone the undersigned attorney so that the present application can receive an early Notice of Allowance.

Respectfully submitted,

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